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ABSTRACT

This study examined the relationship between preschool children's understanding of others' minds, as indicated in their performance on a false beliefs task, and the quality of their social interaction in shared pretend play. Participating were 48 pairs of preschool children enrolled in 4 preschools in both Singapore and the United Kingdom. Same-sex dyads were formed on the basis of the children's theory of mind status and familiarity with each other. Dyads were videotaped for 15 to 20 minutes while engaging in pretend play. Estimates of the quality of social interaction were obtained through the coding of visual regard and social play. Two clear findings emerged from the study. First, children with different "mind reading" abilities interacted in different ways. Children who did not pass the false belief task attained a low level of shared focus when playing together. Second, there were no cultural differences in this finding. When children who passed the theory of mind task were paired with a child who did not, the play was more interactive than when dyads were symmetric in their theory of mind status. (Contains 58 references.) (KB)

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QUALITY OF SOCIAL INTERACTION AND UNDERSTANDING OF OTHER MINDS IN CHILDREN'S PLAY

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Abstract

The key question in this investigation is how do differences in understanding of other minds relate to interaction between peers. If children are observed in pretend play, would individual differences in their understanding of other minds be reflected in the quality of their interactive play? A cross-cultural sample of Singaporean and English dyads of pre-school children were formed based on their performance on a false belief task. Each dyad was then videotaped for twenty minutes while engaging in pretend play. A rating scale of quality of social interactive play was developed and inter-rater agreement checked using both UK and Singaporean pre-school teachers. Videotapes of the forty-eight pairs were further coded for visual regard and social play. Results will be discussed in the light of how ToM status is reflected in the social interaction patterns of the children.

Keywords: Intersubjectivity; social interaction; social pretend play; theory of mind; and visual regard.

1. Introduction

Interest in and research into the development of children's understanding of mental states has expanded rapidly since Premack & Woodruff's (1978) work with chimpanzees. The acquisition of false belief understanding around $4^1/_2$ years of age is now a highly robust and much-replicated finding (Astington & Gopnik, 1991; Perner, Leekam & Wimmer, 1987; Wimmer & Perner, 1983), so much so that false belief understanding has been accepted as a hallmark of the acquisition of a representational theory of mind. It is only recently that there is a considerable number of exploratory inquiries to further understand cross domain continuities in the development of false belief understanding, social cognitive abilities and social skills (see Astington & Olson, 1995; and Barresi & Moore, 1996).

A series of studies conducted by Dunn and colleagues (Brown & Dunn, 1991; Dunn et al, 1991; Dunn & Brown, 1993; Youngblade & Dunn, 1995) have found that differences in family discourse about feelings and causality, verbal fluency of mother and child, and quality of the mother-sibling and child-sibling relationships predicted individual differences in the understanding of false belief and affective perspective-taking. Perner, Ruffman & Leekam's (1994) work also indicated that larger family size is associated with an earlier acquisition of false belief understanding i.e. siblings provide an important context for developing social understanding. In the same paper, Perner et al also ruled out the possibilities of a birth order effect. In addition to the positive relation between children's performance on false belief tasks and the number of siblings they have, Astington & Jenkins (1995) also found an association between children's false belief understanding and certain real world behaviors in children, particularly joint planning in pretend play. They further reported that this relationship was not accounted for by the children's age or language ability (Jenkins & Astington, 1995).

The sibling effect finding suggests that having more siblings allows for an increased number of interactions which involve the effect of beliefs on behavior. A

cross cultural study by Lewis et al (in press) using Greek children further investigated the sibling effect by placing it within the context of other social relationships surrounding the developing child. The researchers wanted to determine whether it was the structure of the social environment[1] or the daily interactions within that structure that influence the child's understanding of mind. They reported replication of the sibling effect but strongly suggested that the direction of causality may be open to question i.e. the more a child interacts with people who are socially more skilled i.e. siblings as well as extended kin, the more the child will learn about how mental states relate to actions (Lewis et al, in press).

In reviewing the evidence of the sibling effect studies (Jenkins & Astington, 1994; Perner et al, 1994) , Harris (1996) proposed that it is conversational competence that may be the key prerequisite for belief understanding. By citing evidence from studies of children with disabilities, he claimed that children with siblings have the advantage of an available partner(s) with whom they can exchange information with via conversation, as a result of which they become sensitive to their partner's presuppositions and knowledge. Distinct from the contemporary research efforts outlined above, Lalonde & Chandler (1995) conducted a preliminary inquiry by comparing false belief understanding in pre-schoolers with teacher ratings of aspects of their social-emotional skills and behaviors. Their findings showed a stronger correlation between a composite measure of false belief understanding and "intentional" aspects of social skills as opposed to "social convention" aspects of social skills

From these various indices, an interesting picture of the role of social interaction in theory of mind development emerges. The primary suggestion is that quality of social interaction is associated with theory of mind development. Though the above account is an important step forward in our understand of children's understanding of other minds, it also serves to highlight the gap in the research literature. Most of the current findings relate to pre-school children and family factors. Relatively little research has explored the topic in the context of peers in the school setting. Although

[1] In this case the family was the social unit used.

5

peer interactions can take place in the home as well as in school, they may be especially important in the school setting because of the limitations characteristic of adult-child interaction in an institutionalized setting. It is in this context in which children can reverse interactional roles with the same intellectual content. In addition, the act of communication itself depends on distinctions that embody understanding about other minds and these are the distinctions which allow for children to achieve shared meaning in their interactions with one another.

One pre-school activity which allows children to achieved shared meaning in an interactive context is play. In early childhood research, pretend play has long provided an important window to view a child's developing social and cognitive competence (Bretherton, 1984; Rubin, 1980). Evidence is accumulating on the cognitive significance of pretend play (Golomb, 1979), intersubjectivity and collaboration in pretense (Dunn & Dale, 1984; Goncu, 1993), perspective-taking and pretense tutoring (Cohn, 1984; Tan-Niam, 1994), and language development and representational play (McCune-Nicolich, 1981; McCune, 1995). Recent work in children's developing theory of mind have examined the emergence of pretend play skills under experimental conditions (Harris & Kavanaugh, 1993; Leslie, 1987; Lillard 1994). Despite the increasing number of investigations looking at play and children's understanding of other minds, few have examined play in natural settings.

Since theory of mind development is closely related to other aspects of social functioning, a more detailed consideration of the role of social cognitive factors in relation to the structuring of ongoing social interaction is required. This paper reports an exploratory study for possible relations between children's developing theories of mind and their interaction with peers in play. The intuitions guiding this exploratory effort were, not only that what we understand of other minds must surely influence the kinds of relationships and interactions we have with our peers, but also that changes in theory of mind development would surely affect the nature of these interactions i.e. play behavior and play talk.

A pilot study was conducted with pre-school children in a naturalistic play setting. Eight children were observed interacting with their peers in spontaneous play in a university based pre-school (UK). Each child was observed for three ten-minute slots a day for three consecutive days. Based on play behavior observations, the experimenter then predicted the theory of mind (ToM) status of each child. The eight children were then tested on the deceptive box task (Perner, Leekam & Wimmer, 1987) and results confirmed all eight predictions i.e. children with ToM status as determined by the Smartie Box task interacted more with their peers than children without ToM status. This pilot study found that the ToM child directed pretend play more often and used meta-communicative remarks more frequently. If both play partners shared ToM status, the play exchange was more collaborative and play was sustained for a longer period.

In view of these observations, the primary purpose of the study was to examine the relationship between children's understanding of other minds and the quality of social interaction in children's shared pretend play. If we observe children in pretend play, would individual differences in their understanding of other minds be reflected in their interactions? More specifically, what visual and verbal differences will one see in the nature of these interactions? What happens when children with different mind reading abilities play together? Drawing upon the Vygotskian concept of the zone of proximal development, would mismatched pairs (i.e. children with different ToM status) enjoy more interactive play? Would the interaction be orchestrated by the ToM child?

The present study also incorporated two cross-cultural dimensions. Firstly, in line with contemporary trends (Lewis et al, in press), subjects included both UK and Singaporean children with the aim of examining differences in social interaction patterns in relation to ToM status. Secondly, it was also important to look at how raters from different cultures evaluate dyadic child-child interactions and to check for agreement of their views. The main objective here would be to compare the raters'

evaluations with the theory of mind status of the dyads in the interaction sequence. This paper reports an initial analysis of the data.

2. Method

2.1 Participants

Informed consent was obtained from all parents of $3^1/_2$, 4-, and 5-year-old children enrolled in four pre-schools in both Singapore and the UK. The participating schools were located near universities in both countries. In this study, 96 participants consisting of 50 girls and 46 boys (M=52.5 months; SD=4.2) were drawn from a larger sample of 108 children. The average family size was 2.1 children for Singaporean as well as UK families. Most of the children were of middle class background. All the children were proficient speakers of English although, for the Singaporean children, English was a second language.

2.2 Dyad formation

In order to form the dyads, the subjects were individually assessed on the unexpected transfer task for false belief modeled on the standard 'Maxi and the chocolate' version (Wimmer & Perner, 1983; see Appendix A). From the results of the unexpected transfer task, the children in each country were assigned to form dyads based on their theory of mind status (see Table 1). The three conditions are referred to as TX (ToM paired with non-ToM), TT (ToM with ToM), and XX (non-ToM with non-ToM) dyads. The proportion for boys and girls was equalized as far as possible for each condition within each country. Dyad partners were of the same sex and were selected from the same classroom. To assure motivation to engage in social pretend play, input from teachers was also used to match partners so that subjects were familiar with each other.

Table 1: Dyad formation and descriptive statistics for TT, XX and TX groups

Dyads	Age range	UK Subjects	SN Subjects
Symmetric TT	48 - 60 months M=54 SD=3.2	3 male pairs 5 female pairs	4 male pairs 4 female pairs
Symmetric XX	44 -59 months M=50 SD=3.7	4 male pairs 4 female pairs	4 male pairs 4 female pairs
Asymmetric TX	46 - 59 months M=53 SD=4.1	4 male pairs 4 female pairs	4 male pairs 4 female pairs

2.3 Play structure and setting

A play corner was set up in a quiet part of the classroom. Play was structured by supplying props that would encourage pretend play along a set theme. Props consisted of a doll, hair brush, toothbrush, soap, towel, bassinet, various empty plastic containers/tubes and a set of doll's clothes. The main reason for one set of props was to encourage interaction, negotiation and conflict. The video equipment was set up near the play corner. To familiarize the children with the presence of the adult observer, the researcher engaged in the routine activities with the children for one week in sessions of 30 minutes each day. Throughout this week, the video camera was set up near the play corner. The children were encouraged to play near the setup to enable them to become comfortable with its presence.

Each dyad was brought to the play corner and then videotaped for 15-20 minutes while engaging in pretend play. The adult present behind the camera only intervened when children moved out of camera range or when conflict became

aggressive. Most of the time, there was minimal and neutral participation from the adult. When questions were directed at the adult, simple non-involved answers were given so that children would not feel awkward or tense.

2.4 Observational measures of social interaction

Estimates of the quality of social interaction[2] were obtained through the use of two mutually exclusive and exhaustive coding schemes: (a) visual regard categories; and (b) social play categories. Visual regard behavior was coded as divided, shared environment, shared props and shared partner. Quality of social play was coded as unengaged, other-object directed, person only, shared passive, and shared coordinated. The operational definitions of the codes are described in Table 2.

Table 2: Coding Categories

Variables	Code	Operational definitions
Visual Regard:		
Divided	V1	Visual attention is divided/different.
Shared environment	V2	Both partners scanning the environment or looking at camera/experimenter.
Shared prop/s	V3	Mutual attention on same props.
Shared partner	V4	Looking at the same props and making eye contact with partner.
Social Play:		
Non-interactive	S0	unengaged/onlooker/other
Other object directed	S1	each child engaged with different objects
Person only	S2	engaged with partner in conversation only
Shared-Passive	S3	engaged with same object or sharing props only
Shared-Coordinated	S4	coordinated partner-object play

[2] Coding of the verbal categories is in progress and have been excluded in this paper.

After three trial runs using different time intervals, a 15-second interval coding procedure was employed as the basic unit of analysis. The targeted social interaction behaviors were then coded from the original video recording of each dyad. The behavior composing the predominance of the interval received credit for occurrence.

2.5 Inter-rater reliability

One coder viewed the video tapes and categorized the visual regard and social play aspects for each successive 15-second interval for all 48 dyads. To check reliability, a random subsample of 25% (12 dyads) of the observations was coded independently by two raters trained to apply the coding system using a standard protocol. They were blind to the theory of mind component in the dyad formation and each rater coded only one set of codes. Agreement was examined using Cohen's kappa, a statistic that corrects for chance (Hollenbeck, 1978). For the 12 dyad sessions checked for visual categories, kappas ranged from .76 (85% agreement in this case) to .91 (95% agreement), with a mean of .85 (89.6% agreement). For social play categories in the 12 dyad sessions checked, kappas ranged from .62 (84% agreement) to .88 (93% agreement), with a mean of .81 (87.8% agreement). The average number of intervals checked per dyad was 66 intervals.

3. Analysis

The study was conducted and initially analyzed in two parts. First, twelve of the forty-eight dyads were selected for a triangulation procedure[3] and preliminary analysis. The two-fold aim of this procedure was (a) to trial and refine the coding categories and (b) to obtain other observers' general judgments of the videotaped sequences (see Corsaro (1981) and Sevigny (1981) for details of process of indefinite triangulation). The triangulation procedure and findings are recounted only briefly here. The second

[3] At a later stage of this research, we would also be interested in looking at the separate issue of cultural differences in raters' observations of children's play behavior.

part involved analysis of all 48 dyads using the coding categories that were refined in the preliminary analysis.

3.1 Triangulation procedure and preliminary analysis

A preliminary analysis was conducted on twelve of the forty-eight dyads to check for agreement on the quality of play interaction by different raters in both cultures. The random selection of the 12 pairs from the original 48 dyads was guided by the basic criteria of 6 pairs from each country with 2 pairs (one male and one female pair) per T-T, X-X and T-X condition.

3.1.1 Rating scales

Two rating scales were developed to examine the extent of sharing and thematic maintenance during the dyads' play. These were presented to the raters in the form of a social interaction questionnaire. Ratings were made on 6-point scales ranging from "hardly ever" (1) to "almost always" (6). Sharing indexed the involvement of the subjects with each other in terms of the use of props, communication of ideas and coordination of play. Dyads received high ratings when observed to be playing well together and low ratings when interaction was judged to be poor. Thematic maintenance, in contrast, reflected the ability of the dyads to negotiate play along a shared theme. The items in each scale were summed to form a composite score in each case.

The rating scales were administered to 11 raters (6 from Singapore and 5 from the UK), all of whom were experienced pre-school teachers. Raters were blind to the ToM status of the subjects. They judged videotapes of the dyads engaged in six minutes' of pretend play. This involved three minutes of initial play and three minutes of middle play. After each dyad's segment of play, the video tape was stopped to allow the raters to complete the rating scales. The 6-minute segments of the 12 dyads were presented in counter-balanced order to the different raters. Based on the sharing scores, it was found that the UK raters were in agreement in ranking the 12 dyads (Kendall's

W=0.64, significant at p<.001). Inter-rater agreement was also adequate for the Singaporean raters (Kendall's W=0.71, significant at p<.001). The thematic maintenance scores are not reported further in this paper. When Kendall's W is significant, a better estimate of the true ranks can be obtained by ordering the sum of ranks as shown in Table 3 (Siegel & Castellan, 1988).

The rankings of the 12 dyads in Table 2 show an interesting pattern. Both the UK and SN raters gave high rankings for the TT pairs. Conversely, with the exception of Pair 5[4], most of the XX pairs were anchored at the bottom of the ranks. The fact that there was agreement of ranks between the two sets of raters from different cultural backgrounds and who were blind to the theory of mind component in the study, strongly suggests a link between children's understanding of other minds and the quality of their interactions with peers.

Table 3: Sharing rankings by UK and Singaporean raters

Raters	Ranks	1	2	3	4	5	6	7	8	9	10	11	12
UK RATERS	Pair #	#1	#8	#10	#11	#13	#15	#5	#6	#2	#4	#9	#12
	ToM status	TT	TT	TX	TX	TT	TX	XX	TT	XX	TX	XX	XX
	Difference between ranks compared to SN raters	1	2	0	1	2	4	6	2	0	2	0	0
SN RATERS	Pair #	#5	#1	#10	#8	#11	#6	#13	#4	#2	#15	#9	#12
	ToM status	XX	TT	TX	TT	TX	TT	TT	TX	XX	TX	XX	XX
	Difference between ranks compared to UK raters	6	1	0	2	1	2	2	2	0	4	0	0

[4] Although Pair 5 was ranked by the SN raters for good quality of social interaction, further verbal analysis showed that there was a large amount of private speech in the interaction. The private speech included a fair quantity of abbreviated language use (containing mostly Singlish/ Singapore English) which the UK raters found difficult to understand. This resulted in the low ranking by UK raters.

3.1.2 Proportion of visual regard and social play categories

To standardize the amount of play time that was observed from the video recording of the twelve pairs, the first 48 intervals were used in the analysis. Figures 1 and 2 show the mean frequencies of the different codes expressed as a percentage of the total time for the twelve pairs. In terms of visual regard, the TT and TX pairs spent a higher proportion of time in shared visual regard categories (see Table 4). In particular, mutual attention on the same props (48.4% for TTs and 44.8% for TXs) and on the play partner (9.4% for TTs and 17.2% for TXs) were high when contrasted with XX pairs' 35.9% shared object and 4.2% shared partner. XX pairs spent much of the time on divided visual regard (58.3%).

Table 4 12 Pairs -- Means (and standard deviations) of visual regard and social play categories as a function of ToM status

Coding categories	TT *M (SD)*	% of total time	XX *M (SD)*	% of total time	TX *M(SD)*	% of total time
Visual regard:						
V1	19.5 (3.7)	40.6	28 (4.7)	58.3	17.3 (3.3)	35.9
V2	0.8 (0.9)	1.6	0.3 (0.5)	0.5	1 (1.2)	2.1
V3	23.3 (6.6)	48.4	17.3 (4.2)	35.9	21.5 (6.4)	44.8
V4	4.5 (3.7)	9.4	2.5 (3.1)	4.2	8.3 (2.5)	17.2
Social play:						
S0	3.8 (2.5)	7.8	3.3 (0.5)	5.2	2.8 (2.8)	5.7
S1	15.3 (6.2)	31.8	28.5 (8.4)	59.4	13.5 (3.1)	28.1
S2	11.3 (10.2)	23.4	10.5 (9.3)	21.9	11 (10.4)	22.9
S3	7.8 (7.5)	16.1	5.3 (5.8)	10.9	9.8 (3.8)	20.3
S4	10 (14.1)	20.8	0.5 (0.5)	2.6	11 (3.6)	22.8

This pattern is repeated to some extent with the quality of social play categories. TT and TX pairs have higher counts with partner only, shared passive as well as

Figure 1 Visual regard -- mean frequencies as % total time

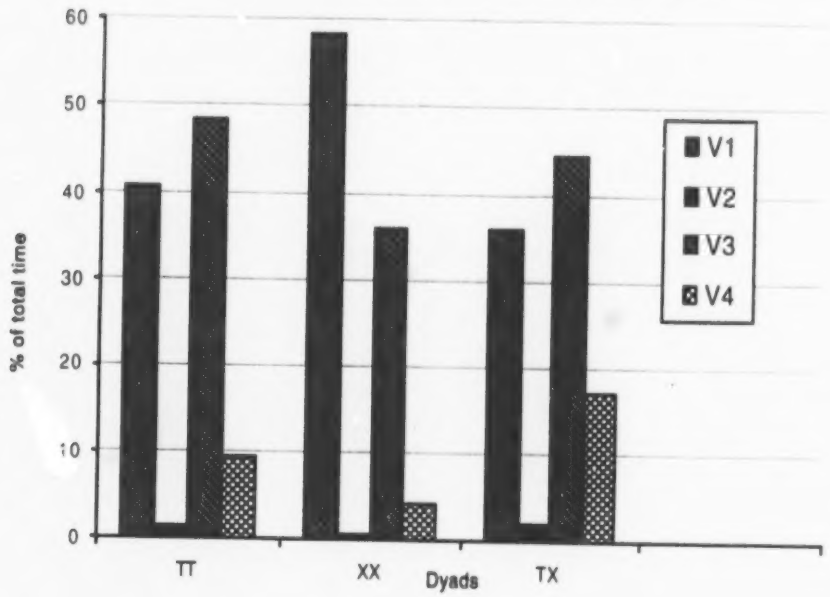
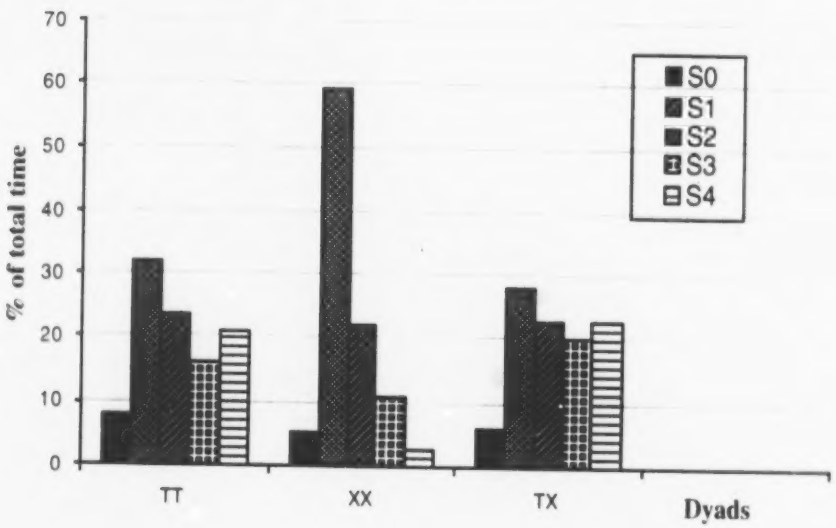


Figure 2 Social play -- mean frequencies as % total time



15

coordinated partner-object engagement (TT 60.3% and TX 66%) as opposed to XX pairs whose combined score on these three categories is only 35.4% of total time. On the other hand, XX pairs have a very high count on other-object directed (59.4% of total time) engagement.

3.1.3 Combination of codes

In order to obtain a general index of intersubjectivity in play, the visual regard and social play codes are presented together in Table 5 in order to view the various combinations of the two sets of codes. The basic unit of analysis is the 15-second interval. The primary objective for this move is to check for common or popular combinations of codes.

Table 5 : Twelve pairs -- Frequencies of visual regard (V1-V4) and social play (S0-S4) codes

	XX Pairs																			
	#12					#9					#5					#2				
	S0	S1	S2	S3	S4	S0	S1	S2	S3	S4	S0	S1	S2	S3	S4	S0	S1	S2	S3	S4
V1	1	**30**	2	0	0	2	**15**	7	1	0	2	**17**	12	1	0	1	**18**	2	2	0
V2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V3	2	9	0	2	0	1	8	5	1	1	1	7	6	1	1	3	8	0	11	1
V4	0	1	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	1	0	0
	TT Pairs																			
	#8					#13					#6					#1				
	S0	S1	S2	S3	S4	S0	S1	S2	S3	S4	S0	S1	S2	S3	S4	S0	S1	S2	S3	S4
V1	3	10	4	3	0	0	11	7	1	0	3	**19**	2	0	0	4	6	1	0	4
V2	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
V3	4	4	3	**14**	1	0	5	**13**	1	1	0	4	6	5		0	2	0	4	**25**
V4	0	0	0	1	0	1	0	5	1	2	0	0	2	0	4	0	0	0	0	2
	TX Pairs																			
	#4					#10					#11					#15				
	S0	S1	S2	S3	S4	S0	S1	S2	S3	S4	S0	S1	S2	S3	S4	S0	S1	S2	S3	S4
V1	0	6	6	0	1	1	11	2	3	1	0	**8**	**8**	1	0	3	**13**	0	3	2
V2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0
V3	1	3	**10**	4	**10**	1	4	0	5	**14**	0	0	**8**	**7**	4	1	2	1	8	1
V4	0	1	5	1	0	0	0	0	3	1	0	2	3	1	4	0	2	1	3	6

Note: Numbers in bold denote the highest frequency of the combination codes. Each unit is a 15s interval.

If we examine the highest frequencies for each dyad, the XX dyads share a common high frequency combination code of 1;1 i.e. 30 occurrences for pair #12; 15 for #9, 17 for #5, and 18 for #2. What this means is that XX pairs tend to have divided visual regard and were often engaged with different object play at the same instant. They did not focus on or follow what the partner was doing and the level of shared focus in their play was low. On the other hand, the TT dyads tended to have more "3" combinations of codes i.e. 3;4 (14) for #8, 3;2 (13) for #13, and 3;4 (25) for #1. This implies that most TT pairs are high in joint visual attention on the same props and are more actively engaged with the partner in social play. The TX pairs display a mixed range i.e. 10 intervals each of 3;2 and 3;4 for #4; 14 (3;4) for #10, 13 (1;1) for #15 and similar frequencies of combinations 1;1, 1;2, 3;2 and 3;3 for #11.

Table 6: Code combinations and ranking status

Dyad	Code combinations	ToM status	UK raters' rankings	SN raters' rankings
#1	3;4	TT	1	2
#6	1;1	TT	8	6
#8	3;3	TT	2	4
#13	3;2	TT	5	7
#2	1;1	XX	9	9
#5	1;1	XX	7	1
#9	1;1	XX	11	11
#12	1;1	XX	12	12
#4	3;2	TX	10	8
#10	3;4	TX	3	3
#11	1;1/1;2/3;2/3;3	TX	4	5
#15	1;1	TX	6	10

When compared with earlier rankings in the preliminary analysis (see Table 6), it is interesting that most of the dyads that are coded low on visual regard and social play are also ranked low in terms of quality of social interaction by the raters. Notably, it is also the case that these are the XX pairs. Although both sets of raters could not agree earlier on #5's ranks, the pair's high 1;1 count indicates the weak interaction between the partners. The TX pairs, with the exception of Pair #15, also have similar combination codes when compared with the TT dyads. This suggests that the asymmetric pairs have better quality of social interaction than XX pairs.

The preliminary analysis of the twelve pairs gave a good indication of the relationship between children's understanding of other minds and the quality of social interaction in their play. It also served to trial the coding scheme before full analysis of the forty-eight dyads in the sample.

3.2 Main analysis

As a result of the preliminary analysis, the social play categories of shared-passive (S3) and shared-coordinated (S4) were collapsed into one single category S3 or shared play for the main analysis of the forty-eight dyads. This will enable a more accurate reading of the data since the finer distinction between S3 and S4 will not be required in this analysis. Although a rare occurrence, shared-coordinated play (S4) is conceptually a higher order type of social play compared to shared-passive (S3) play. The distinction will be re-employed for subsequent analyses. The basic unit of analysis in this section is the 15-second interval.

3.2.1 Visual regard

To standardize the amount of play time that is observed from the video-tapes, the first 36 intervals were used in all subsequent analyses for all dyads. Tables 7 and 8 show the mean frequencies of the different codes expressed as a percentage of total time. In terms of visual regard, the TT and TX pairs in both countries spent a higher

Table 7: Visual Regard--Mean frequencies expressed as % of total time

Country	*Dyad type*	*Visual regard code categories*			
		V1	V2	V3	V4
both	TT	32.5	2.3	55.6	9.7
both	XX	59.2	4	30.2	6.6
both	TX	34.9	5.7	51.4	8
SN	TT	25.3	2.1	57.3	15.3
SN	XX	59.7	2.8	31.3	6.3
SN	TX	35.1	2.8	54.9	7.3
UK	TT	39.6	2.4	53.8	4.2
UK	XX	58.7	5.2	29.2	6.9
UK	TX	34.7	8.7	47.9	8.7

Table 8: Social Play -- Mean frequencies expressed as % of total time

Country	*Dyad type*	*Social play code categories*			
		S0	S1	S2	S3
both	TT	2.8	23.1	27.3	47
both	XX	6.1	60.1	21.7	12.2
both	TX	7.3	29.9	21	41.8
SN	TT	0.7	17	34	48.3
SN	XX	3.5	65.6	19.8	11.1
SN	TX	6.3	31.6	18.4	43.8
UK	TT	4.9	29.2	20.5	45.5
UK	XX	8.7	54.5	23.6	13.2
UK	TX	8.3	28.1	23.6	39.9

19

Figure 3 Visual regard categories as % of total time

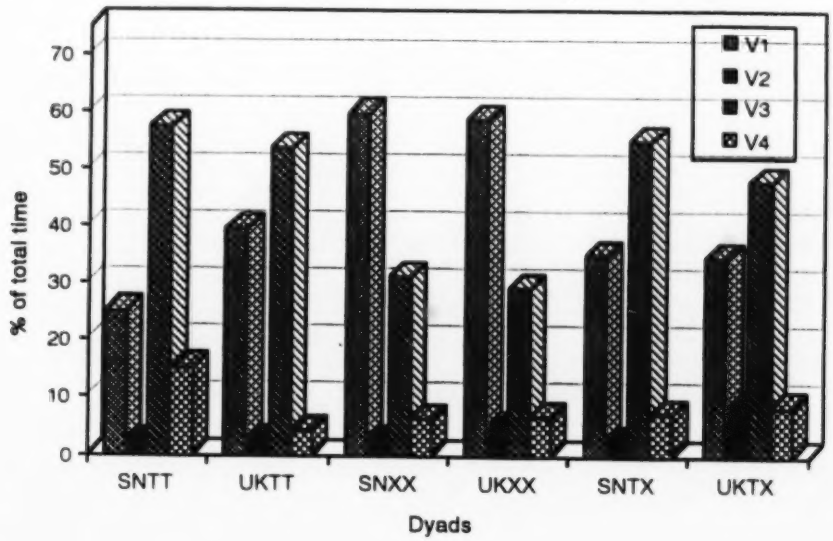
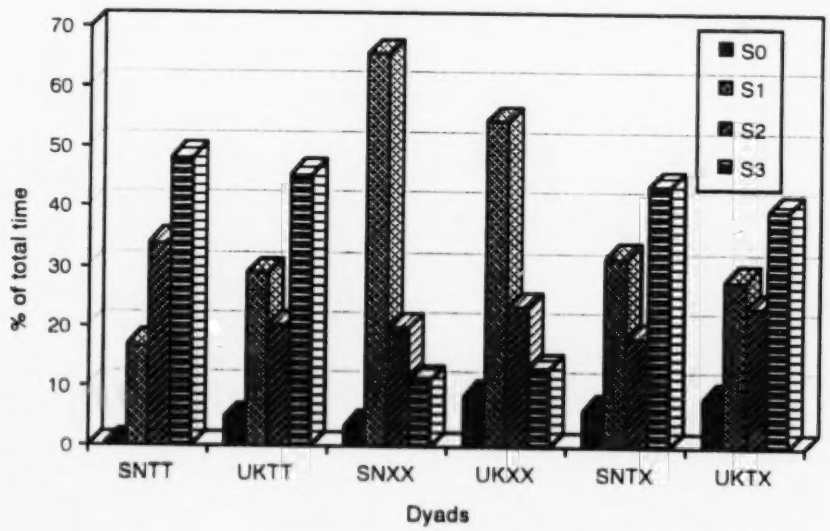


Figure 4 Social play frequencies as % of total time



proportion of time in shared visual regard categories. In particular, mutual attention on the same props (55.6% for TTs and 51.4% for TXs) and on the play partner (9.7% for TTs and 8% for TXs) were high when contrasted with XX pairs' 30.2% shared object and 6.6% shared partner. XX pairs spent much of the time on divided visual regard (59.2%). The breakdown scores for the individual countries yield a similar pattern.

3.2.2 Social play categories

In the social play categories (Table 8), both countries' TT and TX pairs have higher counts with partner only and shared engagement (TT 74.3% and TX 62.8%) as opposed to XX pairs whose combined score on these categories is only 33.9% of total time. On the other hand, XX pairs have a very high count on other-object directed (60.1% of total time) engagement. As with the visual regard frequencies, the breakdown scores for the children from individual countries share a similar pattern.

3.2.3 Symmetric pairs (XX and TT)

As in the preliminary analysis, the combination of the visual regard with the social play codes (Tables 9A, 9B & 9C) provide a general index for intersubjectivity in play. If we examine the highest frequencies for each dyad, the XX dyads share a common high frequency combination code of 1;1 i.e. 144 occurrences for Singaporean and 123 for English pairs. The findings show that XX pairs (see Table 9B) tend to have divided visual regard and were often engaged with different object play at the same instant. The level of shared focus in play was low as they did not follow the partner's activity. On the other hand, the TT dyads (see Table 9A) had more "3" combinations for both countries i.e. 3;3 (109) and 3;2 (45) for Singapore; and 3;3 (104 and 3;2 (27) for UK. As in the earlier analysis of the twelve pairs, TT pairs are high in joint visual attention on the same props and are more actively engaged in social play.

Table 9A TT Pairs -- visual regard and social play code combinations

Visual regard codes	Social play codes							
	SN pairs				UK pairs			
	S0	S1	S2	S3	S0	S1	S2	S3
V1	0	36	30	7	7	60	23	23
V2	1	1	3	1	1	3	3	0
V3	0	11	45	109	6	19	27	104
V4	1	1	20	22	0	1	6	5

Table 9B XX Pairs-- visual regard and social play code combinations

Visual regard codes	Social play codes							
	SN pairs				UK pairs			
	S0	S1	S2	S3	S0	S1	S2	S3
V1	3	144	23	2	3	123	32	11
V2	3	0	4	2	7	2	5	1
V3	3	43	21	22	15	32	14	23
V4	1	2	8	7	0	0	17	3

3.2.4 Asymmetric pairs (TX)

The TX pairs display a fairly balanced range (see Table 9C). For Singaporean TX dyads, there were 98 intervals for combination 3;3 and 62 for 1;1. For UK counterparts, there were 90 intervals for 3;3 and 58 for 1;1. Basically the TX pairs have similar combination codes with the TT dyads. This suggests that the asymmetric pairs have better quality of social interaction than XX pairs. Put simply, in comparison to XX pairs, when a ToM child is paired to play together with a non-ToM child, the play is more interactive.

Table 9C TX Pairs -- visual regard and social play code combinations

Visual regard codes	Social play codes							
	SN pairs				UK pairs			
	S0	S1	S2	S3	S0	S1	S2	S3
V1	2	62	23	15	10	58	14	13
V2	3	3	0	1	10	4	4	6
V3	13	24	23	98	4	12	38	90
V4	1	2	7	11	0	2	12	11

4. Discussion

Two clear findings emerged from this study. Firstly and most importantly, children with different "mind reading" abilities interact in different ways. In particular, children who do not pass the false belief task attain a low level of shared focus when paired to play together. Such a view makes sense because an understanding of other minds must surely be reflected in the children's daily interactions with others, particularly in social pretend play where it requires play partners to attain shared understanding and intersubjectivity in order for play to progress. Secondly, there are no cultural differences for this finding i.e. the pattern of interactions are similar in both cultures. The latter strengthens the main finding by suggesting that understanding of other minds may be a universal trait that underpins children's social understanding.

The study also shows that when a ToM child is paired to play together with a non-ToM child, the play is more interactive. This lends support to the apprenticeship model suggested by Lewis et al (in press) that when a child interacts with others who are better at understanding others' minds, he/she learns more about relating mental states to actions and thereby improves the quality of interaction. To further explore this relationship, current analysis is looking at donor and recipient play behavior in the asymmetric dyads (TX). From the data of the asymmetric pairs, it may be the case that social interactive play may provide a zone of proximal development for the child to learn more about others' mental states.

We recognize that further analysis of the interactions is required before any claims can be made. Further analysis of verbal codes generated from the video tapes is also currently being conducted. What proves interesting so far is the emerging pattern in terms of quality of social interaction and theory of mind. Joint visual regard and quality of social play in pre-schoolers' interaction allow us to observe children's mind reading abilities in a non-experimental context. If anything, the data suggests that acquiring a theory of mind changes the quality of a child's social life.

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Appendix A

Unexpected transfer task
(Wimmer & Perner, 1988; Perner, Ruffman, & Leekam, 1994)

Each child was told a false belief story enacted with dolls and props. The story is about Matthew/Mary who helps his mother to unpack her shopping bag. In the story, Matthew puts the packet of orange juice into the green kitchen cupboard and goes out to play. In his absence, his mother needs some of the juice and then puts it back into the red kitchen cupboard. Matthew becomes thirsty on the playground and wants some juice. The children are asked two questions, "Does Matthew know where the juice is or does he not know where it is (knowledge question) and "Where will Matthew look for the juice?" (belief question). This is followed by a series of memory questions assessing the child's understanding of the basic story facts:

M1. Is it there? (If not, where is it?)
M2. Remember at first, where did Matthew put the juice?
M3. Remember when mother moved the juice? Where did she put it?
M4. Did Matthew see her put it there?